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Growth Strategies, Employment, and Income Distribution in Brazil: An Input-Output Assessment

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Abstract

With a view to analyzing the ability of different sectors to alleviate poverty, this paper analyzes the distributive and employment consequences of expanded production in 90 different sectors of the Brazilian economy. The paper shows that sectors that generate a large number of jobs per unit of capital are also those that distribute a large share of their income to low income groups. Sectors with good distributive performance are also likely to be the most efficient. Hence, it is possible to craft a growth strategy that simultaneously promotes efficiency, employment growth, and income equality.

JEL Classification Numbers:
D57, O15, O54

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Contents

Summary

Some scholars of the Brazilian economy argue that the economic and political crises of the 1980s underscore the need for a new model of economic growth. Central to this debate regarding a new model of growth is the reallocation of production among sectors. In this paper, an assessment is given of the employment and distributive consequences of any such reallocation of production among 90 different sectors of the Brazilian economy.

This paper provides two important methodological improvements over earlier studies examining the distributive and employment aspects of sectoral performance in Brazil. First, by modelling investment as endogenous, the ability of capital-intensive activities to generate income in the construction and capital goods industries is captured. Second, employment generation is calculated in terms of job creation per unit of capital, rather than per unit increase in final demand. Given that the lack of capital is a substantial impediment to employment growth, this seems most appropriate.

The results reveal that there is no conflict in a growth strategy that simultaneously attempts to improve efficiency (reallocate production to sectors with low domestic resource costs), equity (a high share of income accruing to low income groups) and job creation (a high number of jobs per unit of capital). Although sectoral performance on these measures is not always perfectly correlated, in general it is found that good performance on equity is associated with a relatively high degree of efficiency.

The results of this paper lend insights into the debate regarding the distributive impact of structural adjustment in Brazil. If Brazil were to move closer to a free trade regime with undistorted relative prices, it is reasonable to expect that low domestic resource cost (DRC) sectors would flourish, while high DRC sectors would suffer output losses from import competition. Given the positive correlation between performance on efficiency (low DRC), employment, and equity, this implies that structural adjustment, by shifting the composition of production in favor of low DRC sectors, will contribute to greater income equality.

I. Introduction

Some scholars of the Brazilian economy argue that the economic and political crises of the 1980s underscore the need for a new model of economic growth. Not only must economic growth accelerate, but the fruits of economic expansion must be more fully shared by lower income groups. The distribution of personal income in Brazil is very skewed; in 1986, for example, the poorest 50 per cent of the economically active population with income received just 13.5 per cent of all income, while the richest 10 per cent garnered 52.5 per cent (Bonelli and Sedlacek, 1989). The Gini coefficient of income inequality increased further in the 1980s, from .562 in 1981 to .577 in 1986 (Bonelli and Sedlacek, 1989).

Central to this debate regarding a new model of growth is the effect of changes in the sectoral composition of production. Those arguing for a less statist approach to development, for example, expect that lowering tariffs and trade barriers will direct production away from inefficient economic activities. The reallocation of production among sectors undoubtedly has consequences for lower income groups in Brazil, given the differing abilities of sectors to generate employment and income for unskilled labor. Utilizing an input-output framework, this paper assesses the impact of any such reallocation of production on income distribution and job growth by quantifying the employment and distributive consequences of expanded production in 90 different sectors of the Brazilian economy.

The question of just which sectors of the Brazilian economy maximize employment growth and income equality has been addressed in earlier works (Kadota and Prado, 1982; DeJanvry and Sadoulet, 1983; Locatelli, 1985b; the World Bank, 1985; Clements, 1987, 1988; Fonseca and Guilhoto, 1987; Fonseca, 1988; Willumsen, 1988). Utilizing input-output techniques, these studies demonstrate the increase in employment or income by income group that can be expected from an increase in final demand for a sector's output. Despite the useful insights these studies provide, one may well question the policy relevance of the results, especially with respect to the question of which sectors produce the greatest amount of employment. These earlier studies primarily estimate employment in terms of job creation per unit increase in output, rather than jobs per unit of capital. Given that the lack of capital is a substantial impediment to employment growth in Brazil, the most pertinent issue is which sectors create the greatest number of jobs per unit of capital. In this paper a model with endogenous investment is developed that fully measures the capital requirements associated with sectoral expansion and job creation.

It should be emphasized that the analysis in this paper is not normative; that is, this paper does not claim to fashion an optimal allocation of sectoral production for the Brazilian economy. Rather, the emphasis is on describing the distributive and employment consequences of expanded production in various sectors of the Brazilian economy.

This paper is organized as follows. First, the model used to analyze the impact of sectoral expansion on employment and income distribution is delineated. Second, empirical results are presented. Third, the relationships between various measures of sectoral performance (such as income distribution, job creation, and domestic resource cost) are explored. A summary section concludes the paper.

II. Methodology

The purpose of the model developed here is to assess the distributive and employment performance of different sectors of the economy. The model draws on the pioneering work of Miyazawa (1976) linking input-output analysis and income distribution. The Miyazawa model provides the foundation for the vast majority of input-output studies on employment and income distribution in Brazil (Kadota and Prado, 1982; DeJanvry and Sadoulet, 1983; Fonseca, 1986, 1988; Fonseca and Guilhoto, 1986, 1987; Guilhoto, 1986; Clements, 1987, 1988). Variants of the Miyazawa model or models employing the Social Accounting Matrix (SAM) approach have been used to address a number of policy issues in Brazil, among them the impact of income distribution on the structure of production in the Brazilian economy (Bonelli and Vieira da Cunha, 1981; Kadota and Prado, 1985; Locatelli, 1985a, 1985b; Willumsen, 1988).

One significant difference between the methodology developed here and that utilized in the papers cited above is that we choose to leave consumption as exogenous. Making consumption endogenous does little to help differentiate the performance of different sectors in the Brazilian economy, as the consumption multiplier effects are very similar from sector to sector. Because of Brazil's low propensity to use imported inputs, the income creation (and hence second-round consumption multiplier effects) associated with sectoral expansion is very similar for most sectors. Instead of making consumption endogenous, we follow Bonelli and Vieira da Cunha (1983) and the World Bank (1985) and make investment endogenous by treating capital goods and capital structures as intermediate inputs into the production process. The framework developed here builds on the approach delineated in Clements (forthcoming) for modelling the impact of sectoral expansion on employment growth with endogenous investment. The methodological novelty introduced in this paper is that we demonstrate how to assess the distributive impact of sectoral expansion in the context of a model with endogenous investment.

The importance of utilizing a model with endogenous investment is that such a model incorporates the ability of capital-intensive activities to generate jobs in construction and capital goods industries. By treating capital as an intermediate rather than a primary input, we recognize the fact that capital is an input that must be produced, and whose production generates additional employment. Models that treat investment as exogenous do not capture the employment generation associated with producing these capital goods inputs. This leads to a bias in measuring the employment-generating capacity of sectors that utilize capital-intensive techniques. While these sectors may create little direct employment, it is possible that

they indirectly generate substantial job growth in construction and capital goods industries. Thus, by treating investment as endogenous, we arrive at a more accurate depiction of the ability of different sectors to generate employment.

The basic supply-demand equation of the Leontief input-output system states that domestic sectoral output (supply) is equal to the sum of intermediate and final demand for that sector's output, minus imports:

$$X = AX + I + F^* - M \tag{1}$$

where X is domestic output, AX is intermediate goods demand, I is investment, F* is a vector of non-investment final demand composed of consumption, government spending, and exports, and M is imports.

Investment is endogenized by treating capital goods and capital structures as intermediate inputs, with the demand for these inputs dependent on the rate of growth of output. Let V be a square ixj matrix whose typical element v_{ij} represents the share of sector i in supplying the capital goods needed by sector j. Permitting K to designate a diagonal matrix whose diagonal elements indicate incremental capital/output ratios by sector, we have

$$Z = VK \tag{2}$$

where the representative element z_{ij} gives the amount of sector i's output that is needed as a capital good input to support a unit of output in sector j.

An accelerator model of investment is postulated, whereby the production of capital goods and structures in a given year depends on the rate of growth of output by sector:

$$I = GZX \tag{3}$$

where G is a diagonal matrix whose diagonal elements g_{ij} give the rate of growth per sector, which we assume is a uniform 5% per sector.

Imports are comprised of intermediate imports (Mi), capital good imports (Mk), and other final demand imports (Mf*):

$$M = Mi + Mk + Mf^* \tag{4}$$

The quantity of required intermediate imported goods is dependent on the level of output:

$$Mi = AmX \tag{5}$$

The amount of imported capital goods required depends on the rate of growth of output by sector:

$$Mk = GZmX \tag{6}$$

where G is a diagonal matrix of growth rates by sector, and Zm is a matrix whose elements give the amount of imported capital good i that is needed to support the output of sector j.

Designating (F*-Mf*) as E, the exogenous component of final demand (minus imports), and combining equations and solving for X, we have

$$X = (I - A - GZ + Am + GZm)^{-1}E \tag{7}$$

The direct and indirect effects of an increase in final demand for a sector's output can be simulated by supposing a unit increase in exogenous final demand for sector j's output. That is, vector E in equation (7) can be formulated so that element j has the value of one, with zeroes elsewhere in the vector.

Employment effects can be addressed by introducing matrix Al, whose typical element (ij) shows the amount of labor earning class i's labor (in person-years) required to produce a unit of j. The employment effects of expansion in sector j can be measured by

$$L^* = Al\ (I - A - GZ + Am + GZm)^{-1}E \tag{8}$$

where L* is a vector of employment by earnings group.

The number of jobs created per unit of capital is measured by A) quantifying total employment as given in equation (8); B) calculating the amount of capital required to support the sectoral output associated with a unit increase in final demand, as measured in equation (7); and C) taking the job creation figure from A) and dividing by B).

The distributive impact of sectoral expansion can be assessed in a similar fashion. Let income and the distribution of income be determined by the quantity of value added (wages and capital income) that go to each income group per unit of output:

$$Y = AyX \tag{9}$$

where Y is a vector of incomes by income group, and Ay a matrix of distributional coefficients whose typical element (nj) shows the share of sector j's output (per unit) accruing to income group n as income. Hence, typical element (nj) shows the percentage of direct income generated for income group n per unit produced of sector j's output.

Premultiplying the inverted matrix in (7) by the matrix of distributional coefficients, we obtain:

$$Y^* = Ay(I - A - GZ + Am + GZm)^{-1}E \tag{10}$$

where Y* is the vector of income by income class, in which each element measures the amount of income accruing to income group n derived from a unit increase in E.

It should be noted that our model assumes that all value added going to capital from the input-output tables accrues to private Brazilian citizens. Thus, our distributive coefficients are pertinent to the case where we assume the increased output is produced by private Brazilian firms. In the case of expanded output by state firms or foreign capital, the distributive coefficients need to be modified. In particular, data on the share of foreign and state firms in profits by sector must be used to adjust the coefficients showing the amount of direct and indirect private capital income generated per unit increase in output. Thus, the distributional implications of our results could differ in the case that production is undertaken by foreign and state firms rather than private Brazilian enterprises. 1/

Four kinds of data are required for the model: 1) input-output matrices; 2) data on the distribution of value added (wages and capital incomes) to income groups by sector; 3) information on labor requirements (by earnings class) per unit of output; and 4) capital/output ratios. The input-output tables constructed by the Instituto Brasileiro de Geografia e Estatística (IBGE) for 1980, the latest available, are used for matrices A and Am in the model. Data on the distribution of value added by sector to wages and capital incomes are given in the input-output tables. Wages are

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1/ The interested reader is directed to Clements and Moreira (1990) for an attempt to address the impact of foreign firms on income distribution in Brazil.

distributed to different income groups on the basis of data from the Relação Anual de Informações Sociais (RAIS) for 1980, one of the most comprehensive sources on wage distribution in Brazil. RAIS coverage in agriculture, construction, and some service sectors is inadequate, however; for these sectors, data from the 1980 demographic census were utilized. Data on employment requirements, published in conjunction with the 1980 input-output tables, were used to assess employment generation in each sector. These data were combined with RAIS data on the distribution of jobs among earnings groups to calculate the number of jobs created for each earnings group per unit increase in output. The capital/output ratios for matrix K were drawn from Moreira (1989), while information on the disaggregation of investment needs by sector (between various sectors providing capital goods and the construction sector) is provided by IBGE in conjunction with the input-output tables. Data on the share of imports in capital goods were also culled from input-output sources.

In interpreting the meaning of our empirical results, the usual caveats regarding input-output analysis should be observed. Our model assumes fixed technical and distributive coefficients; increased sectoral output could well lead to changes in these coefficients unless one assumes constant-cost supply curves. Policies used to change the sectoral composition of output (such as import liberalization) could also alter these coefficients. Some caveats regarding some of our data should be mentioned as well. As is common with models at such a high degree of disaggregation, some sectoral information is only available at a more aggregated level. With respect to wage data, for example, information is not readily available on the distribution of wages for each of the 90 sectors of the input-output tables. For some of the more finely disaggregated sectors, a common distribution of wages was assumed from the available data (39 sectors) from more aggregated categories. Similarly, our information on capital/output ratios, taken from Moreira (1989) comes at a fairly high level of aggregation (27 sectors). Thus, similar capital/output ratios were assumed for some of the more disaggregated sectors of the input-output table. It is still worthwhile to maintain the 90 sector level of disaggregation, given that so many other pieces of information (such as the share of wages in value added, employment, etc.) are available at this higher level of disaggregation. Nevertheless, in view of these qualifications our empirical results should be viewed as approximations.

III. Empirical Results

Various aspects of employment generation associated with sectoral expansion are reported in Table 1. The results demonstrate that many service sectors, such as domestic servants (sector 88), education (sectors 81 and 87), and family services (sector 79), are the most proficient in the economy at generating jobs per unit of capital. Not all service sectors are associated with high job creation; transportation (sectors 70-73), finance, (sector 76), and real estate rentals (sector 84) are associated with a relatively low jobs/capital ratio.

The results in Table 1 also reveal that agriculture (sector 1) and sectors strongly linked to agriculture, such as food processing (sectors 50-54) generally are associated with a high ratio of jobs per unit of capital. Also of interest is the fact that some sectors considered "capital-intensive" (from the standpoint of job creation per unit of output) are actually associated with relatively high job creation per unit of capital. In sectors that capture natural resource rents, such as nonmetallic mining (sector 3), a relatively small amount of capital is needed per unit of output; hence, even though expanding output in these sectors creates little new employment, a large number of jobs are generated per unit of capital. Thus, one cannot always assume that sectors that stimulate a great amount of employment per unit of output are those that can maximize job creation for a given amount of capital.

Table 1 also reveals that many modern industrial activities are associated with low job creation per unit of capital. Industries such as metallurgy (sectors 10-13), automobiles (sector 22) and chemicals (sectors 33-39) rank among the worst at generating employment, even after taking into account investment-induced job creation associated with these capital-intensive activities. Of additional interest is the dichotomy in employment performance between construction (sector 68) and the capital goods sectors (sectors 14-20). Construction ranks eighth among all sectors in job creation per unit of capital, while capital goods sectors rank among the lowest on this front. Hence, investment projects that more heavily rely on construction (rather than capital equipment) can be expected to engender the greatest employment generation.

The ranking of sectors in terms of their ability to create "good" (high-paying) jobs per unit of capital (GJOBS/K) shows that sectors that create a high number of total jobs (JOBS/K) are also best able to generate a large number of good jobs. 1/ Thus, the promotion of labor-intensive sectors not only can be expected to create a large number of employment opportunities, but also greater opportunities for low-income workers to move to higher-paying jobs.

The distributive performance of different sectors is measured in Table 1 by the variable LOWY, which quantifies the percentage of income accruing to low income groups. Income earners are defined as belonging to a low income group if they earn two times the minimum wage or less. This is a broad definition of those with low income, as the 1980 census reveals that approximately two-thirds of the economically active population earned two minimum wages or less. The definition is chosen because of the questionable quality of data for wage distribution to those earning below the minimum wage. By classifying as "low income" those that earn up to and including two minimum wages, problems of income underreporting that are endemic to the Brazilian census (Pfeffermann and Webb, 1979) are minimized. Changing our

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1/ Good jobs are defined as those that pay more than two times the minimum wage. In 1980, the minimum wage was approximately US$43 per month.

Table 1. Distributive and Employment Performance by Sector

Sector	LOWY	Rank	JOBS/K	Rank	GJOBS/K	Rank
1. Agriculture	.2457	(02)	35.09	(05)	6.54	(42)
2. Metallic Mining	.0412	(88)	15.87	(41)	9.13	(20)
3. Non-Metallic Mining	.0474	(85)	32.15	(06)	19.24	(03)
4. Petroleum Extraction	.0598	(76)	13.99	(44)	7.81	(23)
5. Coal Mining	.0510	(81)	16.75	(36)	9.84	(14)
6. Cement	.0774	(66)	6.80	(85)	3.50	(83)
7. Cement Structures	.1154	(35)	11.93	(54)	5.72	(56)
8. Glass	.1115	(37)	10.80	(64)	5.15	(67)
9. Non-metallic Mineral Products	.1068	(41)	6.86	(84)	3.50	(82)
10. Steel	.1059	(45)	8.54	(76)	4.47	(77)
11. Non-ferrous Metals	.0741	(71)	9.19	(73)	5.36	(63)
12. Cast Iron	.0953	(54)	12.09	(53)	7.18	(32)
13. Other Metals	.0817	(61)	12.45	(52)	7.42	(27)
14. Machines	.0785	(65)	11.56	(59)	7.19	(31)
15. Tractors	.0772	(67)	9.22	(72)	5.55	(60)
16. Machine Maintenance	.0973	(52)	18.73	(30)	12.55	(07)
17. Electrical Energy Equipment	.0867	(59)	12.67	(51)	7.33	(30)
18. Electrical Material	.0744	(70)	11.10	(63)	6.42	(46)
19. Office Equipment	.0750	(69)	11.45	(60)	6.61	(39)
20. Electronic Equipment	.0592	(77)	11.82	(55)	6.78	(36)
21. TVs, Radios	.0790	(63)	11.81	(56)	6.55	(41)
22. Automobiles	.0790	(64)	9.74	(70)	6.04	(53)
23. Autoparts	.0660	(72)	10.50	(65)	6.68	(37)
24. Shipbuilding	.0891	(57)	11.79	(57)	7.78	(24)
25. Trains	.0863	(60)	13.76	(45)	9.43	(16)
26. Other Vehicles	.0497	(82)	11.24	(62)	7.49	(25)
27. Lumber	.1946	(09)	21.93	(20)	11.54	(08)
28. Furniture	.1703	(15)	22.27	(18)	9.19	(19)
29. Cellulose	.1017	(46)	10.14	(68)	44.57	(01)
30. Paper	.0920	(56)	9.68	(71)	5.04	(70)
31. Printing, Graphics	.0984	(51)	13.57	(46)	7.33	(29)
32. Rubber	.1062	(44)	8.44	(77)	4.37	(78)
33. Chemical Elements	.0538	(79)	7.10	(82)	4.13	(79)
34. Alcohol	.1240	(30)	21.88	(21)	6.45	(43)
35. Petroleum Refining	.0397	(89)	8.56	(75)	4.87	(73)
36. Petrochemicals	.0471	(86)	8.20	(78)	4.59	(75)
37. Resins	.0482	(84)	9.03	(74)	5.24	(65)
38. Fertilizer	.0615	(74)	5.25	(87)	2.88	(87)
39. Other Chemicals	.0496	(83)	7.01	(83)	3.88	(81)
40. Pharmaceuticals	.0612	(75)	15.92	(40)	8.76	(22)
41. Cosmetics	.0885	(58)	13.33	(47)	6.30	(47)

Table 1. Distributive and Employment Performance by Sector (Continued)

Sector	LOWY	Rank	JOBS/K	Rank	GJOBS/K	Rank
42. Plastic Forms	.0942	(55)	8.02	(80)	3.96	(80)
43. Articles of Plastic	.0989	(50)	9.83	(69)	4.80	(74)
44. Natural Textiles	.1352	(24)	17.33	(32)	6.58	(40)
45. Synthetic Textiles	.1012	(47)	13.23	(49)	6.12	(50)
46. Other Textiles	.1203	(32)	15.77	(42)	6.85	(35)
47. Clothing	.1580	(21)	19.84	(27)	6.45	(44)
48. Leather	.1621	(18)	16.56	(37)	6.07	(51)
49. Footwear	.1656	(16)	20.96	(23)	6.45	(45)
50. Coffee	.2103	(08)	22.47	(17)	5.14	(68)
51. Rice Processing	.2318	(03)	24.39	(11)	6.07	(52)
52. Wheat Milling	.1729	(13)	23.70	(12)	.79	(90)
53. Fruit Juices	.1336	(27)	18.69	(31)	6.23	(48)
54. Other Vegetable Processing	.1850	(11)	23.31	(16)	6.18	(49)
55. Tobacco	.1005	(48)	16.84	(35)	6.63	(38)
56. Meat Slaughtering	.2125	(07)	23.59	(13)	5.65	(57)
57. Poultry Slaughtering	.2174	(06)	24.88	(10)	5.84	(55)
58. Dairy Products	.2264	(05)	20.96	(24)	5.16	(66)
59. Sugar	.1618	(19)	19.72	(28)	5.60	(59)
60. Unrefined Vegetable Oil	.1905	(10)	20.24	(26)	5.32	(64)
61. Refined Vegetable Oil	.1642	(17)	14.62	(43)	4.94	(12)
62. Animal Feed	.1710	(14)	17.33	(33)	5.03	(71)
63. Other Food Products	.1455	(23)	21.51	(22)	7.45	(26)
64. Beverages	.1341	(26)	16.00	(39)	6.90	(34)
65. Miscellaneous Industrial Products	.0970	(53)	11.59	(58)	5.52	(61)
66. Electrical Energy	.0634	(73)	4.77	(89)	2.96	(86)
67. Public Utilities	.0795	(62)	10.29	(67)	6.96	(33)
68. Construction	.1311	(28)	26.46	(08)	11.20	(09)
69. Wholesale & Retail Trade	.1087	(39)	20.49	(25)	9.25	(18)
70. Highway Transportation	.0765	(68)	12.79	(50)	7.37	(28)
71. Train Transportation	.1204	(31)	17.24	(34)	10.01	(12)
72. Boat Transportation	.1189	(33)	5.03	(88)	2.85	(88)
73. Air Transportation	.1139	(36)	6.16	(86)	3.43	(84)
74. Communications	.0566	(78)	7.84	(81)	5.40	(62)
75. Insurance	.0454	(87)	16.45	(38)	10.68	(10)
76. Finance	.0192	(90)	13.30	(48)	9.09	(21)
77. Hotels & Restaurants	.2306	(04)	23.47	(14)	5.97	(54)
78. Repair Services	.1418	(24)	29.76	(07)	9.94	(13)
79. Family Services	.1003	(49)	66.23	(02)	19.01	(05)
80. Health Care--Private	.1067	(43)	23.42	(15)	9.32	(17)
81. Education--Private	.1186	(34)	38.91	(04)	19.12	(04)
82. Services to Firms	.1068	(42)	22.17	(19)	10.07	(11)

Table 1. Distributive and Employment Performance by Sector (Concluded)

Sector	LOWY	Rank	JOBS/K	Rank	GJOBS/K	Rank
83. Equipment Rental	.0521	(80)	10.34	(66)	5.63	(58)
84. Real Estate Rentals	.1474	(22)	3.03	(90)	1.33	(89)
85. Public Administration	.1607	(20)	18.80	(29)	9.65	(15)
86. Health Care--Public	.1270	(29)	25.00	(09)	14.14	(06)
87. Education--Public	.1847	(12)	40.98	(03)	20.17	(02)
88. Domestic Servants	.9484	(01)	231.54	(01)	3.26	(85)
89. Machine Repair Inputs	.1106	(38)	8.18	(79)	4.51	(76)
90. Firms Services Inputs	.1084	(40)	11.29	(61)	5.12	(69)

Source: Author's calculations.

LEGEND:

LOWY = portion of the income generated by a unit increase in sectoral final demand that accrues to low income groups;

JOBS/K = number of jobs created per unit increase in final demand divided by the amount of capital required to support this increased output;

GJOBS/K = number of good jobs created per unit increase in final demand divided by the amount of capital required to support this increased output.

definition of low income (e.g., defining low income earners as those that earn the minimum wage or less, which equalled 39% of the economically active population in 1980) is not likely to alter the ranking of sectors by distributive performance. Sectors that tend to generate a large amount of income for those earning two minimum wages or less are also those that generate a relatively large amount for those earning up to the minimum wage. Correlation analysis with the wage data from the 1980 RAIS and demographic census data used in our model confirm this point. The correlation coefficient measuring the correlation between the share of sectoral wage income paid to those earning two minimum wages and less and those earning up to the minimum wage is .82, showing a tight relationship between the two variables. The empirical results in Clements (1988) also show that the ranking of sectors by distributive performance is not sensitive to how one defines low income groups. Thus, despite the fact that our definition of low income groups is quite broad, it allows us to rank accurately the ability of different economic activities to generate a large share of income for Brazil's lower income groups.

The ranking of sectors by distributive performance (LOWY) in Table 1 demonstrates that agriculture (sector 1) and sectors with strong ties to agriculture, such as food processing (sectors 50-54) and clothing, leather, and footwear (sectors 47-49) are associated with a high degree of income equality. Labor-intensive service sectors, such as domestic servants (sector 88) and hotels and restaurants (sector 77) are also marked by relative equality of income. Although labor intensity (in terms of job creation per unit of capital) is usually associated with even distributive performance, this is not always the case. Some service sectors,such as family services (sector 79) are able to generate a large amount of jobs per unit of capital (high JOBS/K), but only a modest amount of the income they create accrues to low income groups.

The sectoral ranking by distributive performance provides some interesting insights into the impact of direct government spending on income inequality in Brazil. Relative to other economic activities, a fairly large share of the income generated by public administration (sector 85), public health care (sector 86), and public education (sector 87) accrues to low income groups. This is mainly due to the fact that, by definition, state activities do not directly generate private capital income. 1/ One cannot attribute the distributive performance of state activities to the intensive use of low-paid labor. The share of wages accruing to low income groups in public administration (sector 85), for example, is .1692, ranking it 51st among the 90 sectors in this regard.

It is interesting to note that our ranking of sectors by employment and distributive performance does not differ greatly from previous studies assessing sectoral performance in Brazil at similar levels of disaggregation

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1/ Of course, the net (after tax) income distributive impact of government spending also depends on how the government finances its expenditures.

(Clements, 1987, 1988). Calculating employment performance in terms of job creation per unit of capital (rather than per unit increase in final demand, the measure utilized in previous studies) does have an impact on the ranking of sectors that enjoy large natural resources rents (such as non-metallic mining). For the vast majority of sectors, however, the creation of a large number of jobs per unit of output translates into a relatively modest use of capital; thus, sectors scoring highly from the standpoint of job creation per unit increase in final demand are associated with a high jobs/capital ratio. The other methodological innovation offered in this paper (endogenous investment) also was found to have a relatively small impact on the sectoral rankings. By making investment endogenous, we capture the ability of capital-intensive sectors to generate employment and income in both the capital goods and construction industries. These investment-induced employment and income effects, while not insignificant, are small in relation to the income and employment generated by a sector's demand for primary and intermediate inputs. This follows from the fact that the additional capital goods spending required to support a marginal increase in output in a typical sector is often a modest share (less than 25 per cent) of value added. Thus, the employment and distributive characteristics of a sector are mostly determined by the labor-intensity of the primary and intermediate inputs it uses, rather than by investment-induced effects. In addition, the fact that we calculate employment in terms of job creation per unit of capital (rather than per unit increase in final demand) means that sectors with high investment-induced employment effects will not necessarily score highly from the standpoint of job creation per unit of capital.

IV. Linkages Among Indicators of Sectoral Performance

Further insights into the relationships between measures of sectoral performance can be gained by looking at the Spearman correlation coefficients between variables measuring this performance. Of interest here are not only the relationships between variables measuring performance on equity and employment, but efficiency as well. In this section, the domestic resource cost (DRC) estimates calculated by Hersztajn-Moldau and Pelin (1986) for 1980 are used as a measure of sectoral efficiency. These DRC estimates measure the total cost of domestic resources, at shadow prices, that are needed to generate one dollar of foreign exchange. 1/ DRC provides a useful indicator of efficiency, as sectors characterized by relatively low DRC are those that produce the greatest amount of output per unit of input.

1/ The domestic resource cost (DRC) data from Hersztajn-Moldau and Pelin (1980) are derived from the 1975 input-output table and cover 102 agricultural and industrial sectors. Reconciling these data with the classification scheme of the 1980 input-output tables yielded DRC data for 61 sectors.

Table 2 presents Spearman correlation coefficients between variables quantifying various aspects of sectoral performance. The table reiterates the fact that positive performance on income distribution, such as a high share of income accruing to low income groups (LOWY), is linked to high job creation per unit of capital (JOBS/K), given the high correlation coefficient between these two variables (=.598).

Table 2. Correlation Matrix Among Indicators of Sectoral Performance

	LOWY	GINI	JOBS/K	GJOBS/K	DRC
LOWY	1.000*				
GINI	-.953*	1.000*			
JOBS/K	.598*	-.586*	1.000*		
GJOBS/K	-.061	-.021	.556*	1.000*	
DRC	-.283*	.277*	-.413*	-.011	1.000*

Note: Coefficients indicate Spearman rank correlation coefficients.
*statistically significant at the .05 confidence level.

LEGEND:

LOWY = portion of income that accrues to low income groups;

GINI = Gini coefficient of income distribution; indicates distribution of the income created by a unit increase in sectoral final demand;

JOBS/K = jobs/capital ratio;

GJOBS/K = good jobs (those paying two minimum wages or more)/capital ratio;

DRC = domestic resource cost for 1980, as calculated by Hersztajn-Moldau and Pelin (1986).

The internal consistency of a development strategy emphasizing both equity and efficiency is demonstrated by the significant negative correlation (=-.283) between distributive performance (LOWY) and our measure of efficiency, domestic resource cost (DRC). What the negative correlation between DRC and LOWY shows is that those sectors that generate a large share of income for low income groups also are most efficient, in the sense that they tend to use fewer domestic resources per unit of output. This is due to the fact that sectors that score highly from the standpoint of LOWY intensively use Brazil's abundant low-cost labor resources. Hence, the statistically

significant relationships between LOWY, DRC, and JOBS/K are not surprising, and conform with earlier works on efficiency and distributive aspects of sectoral performance in Brazil (Clements, 1987, 1988).

V. Conclusions

Using a multisectoral model of the Brazilian economy that incorporates an endogenous investment function, this paper has examined the ability of different sectors to generate jobs and income for low income groups within the context of Brazil's capital limitations. The results suggest that there is no conflict in a growth strategy that simultaneously attempts to improve efficiency (reallocate production to sectors with low DRCs), equity (a high share of income accruing to low income groups) and job creation (a high amount of jobs per unit of capital). Although sectoral performance on these measures is not always perfectly correlated, in general we find good performance on equity associated with a relatively high degree of efficiency.

The results of this paper lend some interesting insights into the debate regarding the distributive impact of structural adjustment in Brazil. If Brazil were to move closer to a free trade regime with undistorted relative prices, it is reasonable to expect that the sectoral allocation of production would be altered in favor of those sectors in which Brazil enjoys a comparative advantage. Our measure of efficiency, domestic resource cost (DRC), provides an important benchmark for measuring comparative efficiency. Domestic resource cost measures the opportunity cost of generating a unit of foreign exchange in a tradeable sector. This opportunity cost is quantified as the value of the direct and indirect inputs needed to produce a unit of foreign exchange. For sectors in which DRC is greater than one, the opportunity cost of importing that product is lower than producing it domestically. On the other hand, sectors with DRCs lower than one can be expected to be internationally competitive under a free trade regime. Other things being equal, sectors with the highest DRCs should be least competitive under free trade; those with low DRCs, the most competitive. Thus, if Brazil were to move closer to free trade, it is reasonable to expect that the composition of production would shift in favor of low DRC sectors. Given the positive correlation between performance on efficiency (low DRC), employment, and income equality, this implies that structural adjustment, by shifting the composition of production in favor of low DRC sectors, will contribute to greater income equality. Such an analysis is quite tentative, as the distributive impact of the relative price changes concomitant to structural adjustment and the movement to freer trade have been ignored. Further research on this topic is warranted.

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